Mitigating Double Taxation in an Open Economy*

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Abstract

The interaction of various methods of mitigating economic and international double taxation of corporate source income is studied within a standard neoclassical model of firm behavior. The main purpose is to determine to what extent methods effective in mitigating economic double taxation in a closed economy remain useful in an open economy where the firm's marginal investor is a foreigner. While a cut in the statutory corporate tax rate invariably reduces the cost of capital, the impact of the imputation and split rate systems is shown to depend on whether the credit or exemption method is used in mitigating international double taxation, and the precise design of these methods.

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1 Introduction

The interaction of various methods of mitigating economic and international double taxation of corporate income is analyzed in order to understand how these interact in an open economy. The interaction is modeled by letting a domestic subsidiary distribute dividends to a foreign parent corporation. Of special interest is to inquire into how different methods effective in mitigating economic double taxation in a closed economy remain useful, in the meaning of affecting the cost of capital, in an open economy where the marginal investor is a foreigner. The analysis is carried out in a standard neoclassical model where the effects of the methods are evaluated based on the cost of capital.

The *economic double taxation* (EDT) of corporate income refers to the fact that income is first taxed at the corporate level when it arises and then taxed a second time at the shareholder level when it is distributed. Most of the countries within the European Union integrate the corporate and shareholder taxation and a variety of methods have been employed. Some of them are trivial in the sense that they amount to reduce one of the nominal tax rates involved, i.e. the corporate tax rate or the shareholders' tax rates on dividends or capital gains, or allowing the corporations to accelerate depreciation allowances. Other methods are more complicated, such as the imputation system at the shareholder level, the split rate system and dividend deductions at the corporate level. In the EU Finland, France, Germany, Italy and the United Kingdom have a full or partial imputation system. A couple of countries use special personal tax rates on dividends, e.g. Austria, Belgium, Denmark and Greece. Sweden uses a method based on a tax-free allocation of a fraction of the corporate income. Outside the EU, the United States stays with the so-called classical system, where the corporate and shareholder taxes are not integrated, while Norway has an imputation system.

The *international double taxation* (IDT) follows also from the fact that the corporate income is taxed twice, but this time in different countries. There are two major methods used by the OECD countries to treat the international double taxation; the method of tax exemption and the method of tax credit. Even though most tax treaties between the OECD countries are based on the OECD Model Convention[1] all treaties have special rules and different definitions

[1] See e.g. "Model Tax Convention on Income and on Capital" (OECD, 1996), which comments the articles in the Model Convention. The comments on articles 23A and 23B discuss the exemption and credit method.

that affect the general methods of exemption and credit. Under the tax exemption the foreign parent is allowed to exempt the dividends distributed from the domestic subsidiary before calculating its tax liability. Following countries use some form of exemption:[2] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Luxembourg, the Netherlands, Sweden and Switzerland.[3] According to the tax credit method, the foreign parent is allowed to credit the amount of tax - corporate income tax and withholding tax - already paid by the subsidiary in the domestic country when dividends are distributed. The amount of tax paid in the subsidiary is credit against the amount of tax that would have been paid by the parent if the income had been generated in the foreign corporation. Hence, an additional tax is imposed on the foreign parent if the amount of tax paid in the domestic subsidiary is to low. The credit may be allowed on a worldwide basis (aggregate income from all subsidiaries) or on a source basis (country by country or type of income). Following countries allow the parent corporation to use the tax credit method on a worldwide basis:[4] Iceland, Japan, the United States; and following on a source basis: Greece, Ireland, Italy, New Zealand, Norway, Portugal, Spain, Turkey, and the United Kingdom.

Methods of mitigating EDT have been analyzed and discussed in many different contexts over the years under the assumption of a closed economy. This paper focuses on two of the most common techniques; the imputation system and the split rate system. When corporations are assumed to operate in an open economy the methods of mitigating IDT must also be considered. The interaction between the imputation and the split rate systems on one hand and the methods of tax exemption and tax credit on the other are analyzed. Many technical aspects are surrounding these methods, but I will keep them in very general terms for simplicity. The characteristic of each method and their interaction is nevertheless clearly illustrated.

The terminology of *a closed economy* and *an open economy* in this paper falls back on if a domestic or foreign investor equates the non-arbitrage condition that must hold for a capital market in equilibrium.[5] It says, in short, that the return from investing in bonds must be equal to the return from investing in shares for the marginal shareholder. If the non-arbitrage

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[2] This is based on OECD (1991) and assumes a 100 percent ownership between the parent and the subsidiary corporation.

[3] It may also be the case that a country, e.g. Sweden, uses one of the methods in one treaty, while they use the other method in another treaty.

[4] According to OECD (1991).

condition holds for a domestic investor, i.e. the investor invests both in bonds and shares, the marginal shareholder is domestic and the economy is denoted closed. An economy is said to be open whenever the marginal shareholder is foreign, i.e. the foreign investor equates the non-arbitrage condition.[6]

Boadway and Bruce (1992) argued that the methods of mitigating EDT at the shareholder level (personal dividend tax credit in their model) would have no effect in the open economy. The reason for this is that the dividend tax credit at the personal level is typical a residence based tax, implying that the foreign marginal shareholder is not included in the relief. The main point in Devereux and Freeman (1995), who extended the paper of Boadway and Bruce, is that the effect of introducing any method at the shareholder level in an open economy really depends on how the methods are designed and if the marginal shareholder is domestic or foreign, which they illustrate in a very simple and stylized model. I will extend the analysis of Devereux and Freeman by explicitly deriving a model for specific methods of mitigating EDT and IDT and, thereby, have the possibility to analyze what determine the cost of capital and how the methods interact.

Following this chapter, the cost of capital and the methods of mitigating EDT are derived in chapter 2 under the assumption of an open economy. In chapter 3 the methods of mitigating IDT are introduced in the model. It contains further the analysis of the interaction between the methods. Chapter 4 summarizes and concludes.

2 The cost of capital in an open economy

2.1 Introduction

The cost of capital will be derived in a general model illustrating the classical system, the imputation system and the split rate system. This kind of model have been derived and discussed in a closed economy context, among others, by King (1974), Auerbach (1983) and Poterba and Summers (1985) in a discrete time set up and by Bergström and Södersten (1981) in continues time. I will instead assume that the economy is open, implying that the marginal

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[5] The non-arbitrage condition will be formulated algebraic in chapter 2, equation (7).

[6] There is in principal nothing saying that the marginal shareholder could not be domestic in an open economy. However, for simplification of the terminology the term “open” is used as synonymous with foreign marginal shareholder and the term “closed” synonymous with domestic marginal shareholder.

shareholder may be foreign. This is modeled by letting a foreign corporation (the parent) do its business through a wholly owned domestic corporation (the subsidiary) that operates in an open economy. This implies that the marginal shareholder in the subsidiary automatically is foreign.[7] The subsidiary is performing its business under the domestic government's laws, tax code and accounting rules. In other words, the subsidiary is a "true" domestic corporation with a foreign owner. In deriving the subsidiary's cost of capital I will first set up financial and legal constraints that describe the subsidiary together with constraints due to the split rate and imputation systems. Out of the non-arbitrage condition that must hold in equilibrium for the parent's investment alternatives follows the subsidiary's market value, which will be maximized with respect to the constraints. These steps are outlined below and give the cost of capital under two regimes, the retention regime and the new share issue regime.[8]

2.2 Corporate constraints and the regimes

The most fundamental constraint is the cash flow constraint that in principle restricts the amount of dividends that can be distributed;[9]

$$F\left(K\right)+N^{f}=D+I+T, \qquad (1)$$

where $F(K)$ is the production function[10], I is gross investment and T is the amount of tax paid by the subsidiary. The amount of new share issues N^{f} is in terms of the foreign parent since only it can contribute with more capital, while $F\left(K\right)$, D, I and T are in terms of the domestic subsidiary.

The split rate system is a method at the corporate level and, hence, it affects the cash flow constraint (1). According to the split rate system, see e.g. Södersten (1977), two different domestic tax rates exist on the subsidiary's income; τ_{dist}^{d} if the income is distributed to the

[7] It does not matter for the discussion if the corporation in the domestic country is a wholly owned subsidiary or not. It may very well be the case that the domestic corporation has both domestic and foreign owner, but the important thing is that the marginal shareholder is foreign.
[8] The retention regime corresponds with the old, or traditional, view of dividend taxation and the new share issue regime corresponds with the new view of dividend taxation.
[9] Debts may be excluded from the model without any loss of generality.
[10] The output price is set to unity implying that the production function represents the subsidiary's gross earnings. The production function is assumed to exhibit positive but diminishing marginal product, $F_K>0$ and $F_{KK}<0$, which guarantees an optimal solution to the optimization problem.

parent and τ^d if the income is retained in the subsidiary. The tax rate on distributed income is smaller than on retained income since the purpose is to reduce the EDT. It is eliminated totally when $\tau^d_{dist} = 0$. Dividends are defined after corporate tax implying that $\frac{D}{1-\tau^d_{dist}}$ is the distributed income before domestic tax, which, in turn, means that $\tau^d_{dist}\frac{D}{1-\tau^d_{dist}}$ is the amount of tax the subsidiary pays on the distributed income. The amount of taxable income not distributed to the parent is retained in the subsidiary, i.e. $F(K)-\delta K-\frac{D}{1-\tau^d_{dist}}$, where δ is the economic depreciation rate of the capital stock. The tax liability in the subsidiary equals the sum of taxes, i.e. $T = \tau^d_{dist}\frac{D}{1-\tau^d_{dist}}+\tau^d\left(F(K)-\delta K-\frac{D}{1-\tau^d_{dist}}\right)$. The split rate system is modeled by substituting the expression for *T* into the cash flow constraint (1), which gives the subsidiary's budget constraint as;

$$D = \left(1-\tau^d_{dist}\right)F(K)+\frac{1-\tau^d_{dist}}{1-\tau^d}\left(N^f - I + \tau^d \delta K\right). \tag{2}$$

Since the imputation system is a method at the shareholder level it does not affect the cash flow within the subsidiary. An imputation system can be seen as the domestic government increases the amount of dividends distributed. If ϕ is the rate of imputation, the domestic government adds $\frac{\phi}{1-\phi}$ for every unit of income the subsidiary distributes. If *D* is distributed, the domestic shareholders receive an amount, before personal tax, of D^d;

$$D^d = D\left(1+\frac{\phi}{1-\phi}\right)=\frac{D}{1-\phi}. \tag{3}$$

If the shareholders are allowed to credit the whole amount of the subsidiary's tax, i.e. $\phi = \tau^d$, the shareholders receive full credit for the amount of tax paid by the subsidiary and, hence, the EDT is eliminated. If ϕ is less than τ^d, the shareholders are only allowed to credit a fraction of the corporate tax implying a reduced, but not eliminated, double taxation.

The subsidiary belongs to one of two regimes depending on how the marginal investment is financed. The budget constraint (2) can be rewritten as $I = RE + N^f$, where RE is the retained earnings in the subsidiary.[11] Hence, the subsidiary has two sources of financing at the margin; retained earnings or new share issues. I will put a restriction on the amount of income distributed in order to illustrate the two different regimes. Following Auerbach (1984) the corporations must distribute dividends and, at least, meet a minimum dividend payout ratio;

$$D \geq f\left(1-\tau_{dist}^{d}\right)\left(F\left(K\right)-\delta K\right). \tag{4}$$

The constraint says that the dividends may not fall below a fraction f of the after-tax income. The two different regimes are distinguished depending on how the marginal investment is financed. In the *retention regime*, the dividends are greater than the dividend floor in (4). The subsidiary has the possibility to reduce the dividends, i.e. increase RE, and still meet the minimum payout ratio, implying that the marginal investment is financed with retained earnings. In contrast, the marginal investment is financed with new share issues in the *new share issue regime* where the dividend constraint (4) is binding. This is because the amount of retained earnings is exhausted and becomes fixed. According to $I = RE^{fix} + N^f$, the marginal investment must be financed with new share issues.

The subsidiary is only allowed to distribute income to the parent through dividends. The parent is particularly not allowed to repurchase its own shares, modeled as;

$$N^f \geq 0. \tag{5}$$

Further, the subsidiary is not allowed to accelerate the depreciation of the capital stock. This implies that the capital stock and the book capital stock are equal in the model. As a result, it is only one equation of motion, which shows how the capital stock changes over time due to investments and economic depreciation;

$$\dot{K} = I - \delta K. \tag{6}$$

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[11] The retained earnings become $RE = \left(1-\tau^{d}\right)\left[F\left(K\right)+\tau^{d}\delta K-\frac{1}{1-\tau_{dist}^{d}}D\right]$.

2.3 The cost of capital

A capital market is in equilibrium when the marginal investor is indifferent between an investment in bonds at the rate i, with the return given on the left hand side, and shares, with the return given on the right hand side of the non-arbitrage condition;

$$i\left(1-\tau^{f}\right)V_{t_0}=\kappa\frac{D_{t_0}}{1-\phi}+\left(1-\tau_c^{f}\right)\left(\dot{V}_{t_0}-N_{t_0}^{f}\right). \tag{7}$$

The marginal shareholder is assumed to be the foreign parent corporation and not the shareholders of the parent, see e.g. Sinn (1993). In (7), V_{t_0} is the value of the subsidiary, $\dot{V}_{t_0}$ is the change in the value, and $\frac{D_{t_0}}{1-\phi}$ is the actual amount of dividends that would have reached domestic shareholders under the imputation system according to (3); all at time t_0. But the marginal investor is a foreigner and the parameter κ captures the effect of different methods of mitigating IDT and how these methods are designed.[12] Since the foreign parent is the only owner of the subsidiary the marginal shareholder is automatically foreign, implying that the tax rates in the non-arbitrage condition (7) belongs to the foreign parent. τ^{f} and τ_c^{f} are the foreign corporate tax rates on interest income and capital gains, respectively.

Solving (7) forward gives the market value of the subsidiary in the domestic country as;

$$V_t=\int_{t=t_0}^{\infty}\left(\frac{\kappa}{\left(1-\tau_c^{f}\right)\left(1-\phi\right)}D_t-N_t^{f}\right)e^{-i\frac{1-\tau^{f}}{1-\tau_c^{f}}(t-t_0)}dt. \tag{8}$$

V_t equals the present value of the net cash flow to the parent, i.e. adjusted dividends minus the capital contribution through new share issues. The problem of maximizing the market value of

[12] When no method is employed for mitigating IDT the parameter becomes $\kappa=1-\tau^{f}$, which is the most common interpretation in the literature. This implies that the parent receives $\left(1-\tau^{f}\right)D/\left(1-\phi\right)$ when the subsidiary distributes D and the domestic government adds $\phi/\left(1-\phi\right)$ according to the imputation system. Note that the split rate system is incorporated in D through the budget constraint (2).

the subsidiary given in (8) under the constraints (2), (4), (5) and (6) is formalized as (index t is omitted);

$$\text{Max } V(K) = \int_{t=t_0}^{\infty} \Lambda\left(K, \dot{K}, I, N^f, D; t\right) e^{-i\frac{1-\tau^f}{1-\tau_c^f}(t-t_0)} dt,$$

where
$$\Lambda(\cdot) = \kappa \frac{D}{\left(1-\tau_c^f\right)(1-\phi)} - N^f$$

$$+\mu_D\left[\left(1-\tau_{dist}^d\right)F(K) + \frac{1-\tau_{dist}^d}{1-\tau^d}\left(N^f - I + \tau^d \delta K\right) - D\right]$$

$$+\eta_D\left[D - f\left(1-\tau_{dist}^d\right)\left(F(K) - \delta K\right)\right] + \eta_N N^f + \mu_K\left[I - \delta K - \dot{K}\right].$$

Assuming a steady state solution, the necessary and sufficient first order conditions with respect to *I*, N^f, *D* and *K* are given by;[13]

$$I: \qquad -\mu_D\left(\frac{1-\tau_{dist}^d}{1-\tau^d}\right) + \mu_K = 0,$$

$$N^f: \qquad -1 + \mu_D\left(\frac{1-\tau_{dist}^d}{1-\tau^d}\right) + \eta_N = 0,$$

$$D: \qquad \frac{\kappa}{\left(1-\tau_c^f\right)(1-\phi)} - \mu_D + \eta_D = 0,$$

$$K: \qquad \left(\mu_D - f\eta_D\right)\left(1-\tau_{dist}^d\right)F_K(K) - \mu_K\left(\delta + \frac{1-\tau^f}{1-\tau_c^f}i\right)$$

$$+\eta_D f\left(1-\tau_{dist}^d\right)\delta + \mu_D\left(\frac{1-\tau_{dist}^d}{1-\tau^d}\right)\delta\tau^d = 0.$$

The cost of capital is the lowest acceptable rate of return on a new investment and is equated to the first derivative of the production function with respect to the capital stock, $F_K(K)$. The cost of capital net of economic depreciation, i.e. $\rho = F_K(K) - \delta$, in the retention regime (RR) and the new share issue regime (NSIR) become;

[13] See appendix for details.

$$\rho^{RR} = \frac{\left(1-\tau^{f}\right)i}{\left(1-\tau^{d}\right)\left(1-\tau_{c}^{f}\right)} \tag{9}$$

and

$$\rho^{NSIR} = \frac{\left(1-\tau^{f}\right)i}{\left(1-f\right)\left(1-\tau^{d}\right)\left(1-\tau_{c}^{f}\right)+f\kappa\left(1-\tau_{dist}^{d}\right)\frac{1}{1-\phi}}. \tag{10}$$

From (9) it is clear that neither the imputation nor the split rate system affect the cost of capital in the retention regime. This is explained by the fact that any additional cash flow generated by the marginal investment in the subsidiary is distributed to the parent. It cannot be used to reduce the amount of the new share issues since it already equals zero. Hence, the less expensive source of financing is already used, which implies that the cost of capital is unaffected. One can also conclude that the methods of mitigating IDT, captured by κ, have no effect on the cost of capital in the domestic subsidiary. The intuition of this finding follows also from the fact that the subsidiary already uses the less expensive source of financing. The cost of capital is unaffected to whom, domestic or foreign, the dividends are distributed.

A first comparison of the costs in the two regimes, (9) and (10) makes it clear that the cost is not the same in all corporations. It depends on how the marginal investment is financed. A more comprehensive comparison is postponed to chapter 3 where κ is defined. A further result concerns the effect of the domestic corporate tax rate, τ^{d}, in a small open economy. Apprehension has been raised that the domestic corporate tax rate plays no role in determining the cost of capital in a domestic corporation (the subsidiary) when the marginal shareholder is foreign (the parent). But, as shown in (9) and (10), this apprehension is wrong. The domestic corporate tax rate does affect the cost in both the retention and the new share issue regime in open economies. Moreover, the result holds independent of which method that is used for mitigating IDT and how it is designed.

3 The interaction between methods of mitigating EDT and IDT

3.1 Introduction

I next focus on the methods of mitigating IDT; tax credit and tax exemption. The parameter κ will take different values depending on which method that is used and how it is designed.

According to the non-arbitrage condition (7) the amount of dividends the foreign parent receives from the domestic subsidiary is;

$$D^{f} = \kappa \frac{D}{1-\phi}. \tag{11}$$

When no method is employed for mitigating IDT the amount of dividends distributed from the subsidiary to the parent will be taxed at the foreign corporate tax rate, implying that $\kappa = 1-\tau^{f}$. After deriving κ for the different methods follows the analysis of how the methods of mitigating EDT remains useful in an open economy. Out of the analysis follows also what factors that determine the cost of capital.

3.2 The methods for mitigating international double taxation

i) Tax Credit

Under the tax credit method the parent is offered a credit for the amount of tax already paid by the subsidiary. Assume for the moment that the domestic corporate tax rate is τ^{d}_{eff}. This is just to illustrate how the method of tax credit works; the factor τ^{d}_{eff} will be defined below. From the perspective of the parent corporation the amount of income generated in the subsidiary before domestic tax is $\psi = \frac{D/(1-\phi)}{\left(1-\tau^{d}_{eff}\right)}$.[14] The tax liability would be $\tau^{f}\psi$ if the income were generated in the foreign country. The parent then credits the domestic tax that has been paid by the subsidiary, which equals $\tau^{d}_{eff}\psi$. The net tax paid by the foreign parent then equals $\left(\tau^{f}-\tau^{d}_{eff}\right)\psi$. The amount of dividends received by the parent equals $D^{f} = \left(\frac{1-\tau^{f}}{1-\tau^{d}_{eff}}\right)\frac{D}{1-\phi}$[15] and, hence;

$$\kappa = \frac{1-\tau^{f}}{1-\tau^{d}_{eff}} \tag{12}$$

[14] Remember from the non-arbitrage condition (7) that the foreign parent values the subsidiary based on an amount of dividends equal to $D/(1-\phi)$. So, from the parent's perspective the amount of income before domestic tax is ψ as in the main text, even though the actual income in the subsidiary before domestic tax is $D/\left(1-\tau^{d}_{eff}\right)$.

in the tax credit method according to (11).[16] The interesting parameter in (12) is the *domestic effective corporate tax rate* τ^d_{eff}. It takes different values depending on how the method of tax credit is designed. Two different scenarios may appear.

In scenario 1 the foreign government takes into account that τ^d_{eff} is lower than the nominal τ^d when any method is employed for mitigating EDT. This is modeled in various papers by using an *average* domestic corporate tax rate.[17] I will instead calculate an *effective* corporate tax rate. Note that the effective rate also considers other differences, besides the methods of mitigating EDT, between the countries that the foreign government would like to control for.

In deriving τ^d_{eff} note that the income generated in the subsidiary, from its own perspective, is $\frac{D}{1-\tau^d_{dist}}$ and the amount received by the domestic shareholders is $\frac{D}{1-\phi}$. The domestic effective corporate tax rate can then be solved as;[18]

$$\tau^d_{eff} = \tau^d_{dist} - \left(1-\tau^d_{dist}\right)\frac{\phi}{1-\phi}. \tag{13}$$

Substituting (13) into (12) gives the relevant expression for κ in scenario 1 as;[19]

$$\kappa = \left(1-\phi\right)\frac{1-\tau^f}{1-\tau^d_{dist}}. \tag{14}$$

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15 $D^f = D/\left(1-\phi\right) - \left(\tau^f - \tau^d_{eff}\right)\psi$

16 There is no withholding tax in the model for simplification of the expressions. Adding the withholding tax implies that $\kappa = \left(1-\tau^f\right)/\left(1-\tau^d_{eff}\right) + \tau^{withholding}$. The general conclusions outlined are the same.

17 Keen (1990), OECD (1991) and Hines (1994) are examples of where the average domestic corporate tax rate approach is used and discussed. The average tax rate is basically calculated as the ratio of the amount of tax paid by the subsidiary in the domestic country over the subsidiary's taxable income from the foreign parent's perspective.

18 $D/\left(1-\tau^d_{dist}\right)\left(1-\tau^d_{eff}\right) = D/\left(1-\phi\right)$

19 If this expression is substituted into the non-arbitrage condition (7) the imputation parameter ϕ cancels and the amount of dividends D is scaled by $\left(1-\tau^f\right)/\left(1-\tau^d_{dist}\right)$, which is less than unity under the tax credit method and thereby correcting for the split rate system. Hence, the value of dividends is reduced when the foreign government controls for the methods of mitigating EDT in the domestic country.

As an alternative, scenario 2, the domestic effective tax rate is set equal to the nominal rate, i.e. $\tau_{eff}^{d}=\tau^{d}$. This implies that the foreign government ignores the fact that the domestic effective corporate tax rate is different from the nominal due to the methods of mitigating EDT. From (12) the parameter κ in scenario 2 becomes;

$$\kappa=\frac{1-\tau^{f}}{1-\tau^{d}}. \qquad (15)$$

<u>ii) Tax Exemption</u>

In the second method of mitigating IDT, the method of tax exemption, dividends distributed from the subsidiary to the parent are exempted from tax as long as the corporate income is taxed domestically. Since $\frac{D}{1-\phi}$ is the amount of dividends after domestic corporate tax, dividends are not taxed in the foreign country, implying $D^{f}=\frac{D}{1-\phi}$ and, hence, $\kappa=1$ according to (11).

3.3 The interaction between the different methods

All components for evaluating the cost of capital under different methods have now been derived. Since the cost is unaffected of any method of mitigating IDT in the retention regime focus is now solely on the new share issue regime. Hence, the benchmark equation from which the cost of capital in the different cases can be derived is expression (10), which is rewritten here for clarity;

$$\rho^{NSIR}=\frac{\left(1-\tau^{f}\right)i}{\left(1-f\right)\underbrace{\left(1-\tau^{d}\right)\left(1-\tau_{c}^{f}\right)}_{(1-f)-part}+f\underbrace{\kappa\left(1-\tau_{dist}^{d}\right)\frac{1}{1-\phi}}_{f-part}}.$$

The cost of capital equals the after tax return on the alternative investment grossed up by two parts. The fraction $\left(1-f\right)$ of the income is retained in the subsidiary and therefore taxed at the domestic tax rate and the foreign tax rate on capital gains. The fraction f of the income is distributed to the parent and the cost is, for that reason, affected by the methods of mitigating EDT and IDT. Since the methods only affect the fraction of the income that is distributed it is more convenient just to analyze this part.

Table 1: The f-part in the new share issue regime

	I		II		III		IV
	No method $\kappa = 1-\tau^f$		Tax credit, scenario 1 $\kappa = (1-\phi)\frac{1-\tau^f}{1-\tau^d_{dist}}$		Tax credit, scenario 2 $\kappa = \frac{1-\tau^f}{1-\tau^d}$		Tax exemption $\kappa = 1$
The classical system $\tau^d_{dist} = \tau^d$, $\phi = 0$	$(1-\tau^f)(1-\tau^d)$	<	$(1-\tau^f)$	=	$(1-\tau^f)$	?	$(1-\tau^d)$
The imputation system $\tau^d_{dist} = \tau^d$, $\phi > 0$	$(1-\tau^f)\frac{(1-\tau^d)}{(1-\phi)}$	<	$(1-\tau^f)$	<	$(1-\tau^f)\frac{1}{(1-\phi)}$	?	$\frac{(1-\tau^d)}{(1-\phi)}$
The split rate system $\tau^d_{dist} < \tau^d$, $\phi = 0$	$(1-\tau^f)(1-\tau^d_{dist})$	<	$(1-\tau^f)$	<	$(1-\tau^f)\frac{(1-\tau^d_{dist})}{(1-\tau^d)}$	?	$(1-\tau^d_{dist})$

Note: A higher f-part implies a lower cost of capital.

Column I in table 1 illustrates the different systems when no method is employed for mitigating IDT. As is clear from the classical system the f-part is taxed fully both by the foreign and the domestic country. This is to be compared to the cases where the imputation and split rate systems are employed, where the amount of domestic tax paid on the income is reduced, either by ϕ or τ^d_{dist}, respectively. The f-part increases and, as a result, the cost of capital decreases. Hence, under full IDT the effective methods in mitigating EDT in a closed economy remain useful in an open economy. The cost of capital is reduced under the imputation and split rate systems.

The f-parts under the method of tax credit are in column II and III in table 1. When the foreign government corrects for the fact that the domestic effective corporate tax rate is lower than the nominal (scenario 1), the f-parts equal $(1-\tau^f)$ under all systems. This is seen in column II. The domestic tax rate or any share of it does not show up implying that the IDT is effectively eliminated. But, correcting for a lower effective domestic corporate tax rate makes, of course, the methods of mitigating EDT ineffective. Some interesting special cases arise when the domestic country has employed an imputation system or a split rate system totally. When the split rate system is used to its maximum, $\tau^d_{dist} = 0$, it does not matter if no method or the tax credit method (scenario 1) are employed for mitigating IDT. The cost of capital is the same in both cases. The result reappears in the case the imputation rate parameter equals the domestic corporate tax rate, i.e. $\phi = \tau^d$.

In column III of table 1 the foreign government ignores the fact that τ^d_{eff} may be lower and uses instead τ^d when calculating the amount of tax credit (scenario 2). Compared to column II, the imputation and the split rate systems remain useful when the tax credit method is employed. This implies that both the methods of mitigating EDT and IDT affect the cost. As a result the costs of capital become lower compared to the tax credit (scenario 1) and to the case when no method is employed. The income from the subsidiary becomes untaxed when the split rate system is used totally if the domestic and foreign tax rates are equal, $\tau^d = \tau^f$. The result reappears under the imputation system in the case $\phi = \tau^d = \tau^f$.

As is clear from column IV the f-parts and, hence, the costs of capital are independent of the foreign tax rate when the method of tax exemption is employed. This is because dividends are tax exempted. Compared to column I where no method is employed, the f-parts have become $1/(1-\tau^f)$ times larger. In the nature of the tax exemption method lies that the foreign government accepts both the domestic tax rate and the different methods employed for mitigating EDT. As a consequence, both the imputation and the split rate systems remain useful. Further, as long as $\tau^d < \tau^f$ the tax exemption gives the highest measure of the f-part, implying the lowest cost of capital.

So far the imputation and the split rate systems have been assumed to cover both domestic and foreign shareholders. However, it is possible to design any method at the shareholder level to only cover domestic shareholder. If the imputation system only covers domestic shareholders, the foreign parent does not benefit from the method. Under the methods of tax credit and exemption the imputation parameter ϕ is set to zero, implying an increased cost of capital.

The distinction between different owner is not possible to do when a method at the corporate level is employed, like the split rate system.

3.4 A comparison of the cost of capital in the two regimes

Given the methods of mitigating EDT and IDT it is possible to compare the cost of capital in the retention and new share issue regime. This is done by rewriting the cost in the new share issue regime (10) in terms of counterpart in the retention regime (9). The relationship becomes;

$$\rho^{NSIR} = \rho^{RR}\left(\frac{(1-\tau^d)(1-\tau_c^f)}{(1-f)(1-\tau^d)(1-\tau_c^f)+f\kappa(1-\tau_{dist}^d)\frac{1}{(1-\phi)}}\right) \quad (16)$$

By comparing the nominator and the denominator in (16) it is possible to set up constraints on the parameter to give a specific relation between the costs of capital. Table 2 shows the constraints for the cost of capital to be higher in the new share issue regime.

Table 2: Restrictions on the parameters for the cost of capital to be higher in the NSIR

	I	II	III	IV
	No method $\kappa = 1-\tau^f$	Tax credit, scenario 1 $\kappa = (1-\phi)\frac{1-\tau^f}{1-\tau_{dist}^d}$	Tax credit, scenario 2 $\kappa = \frac{1-\tau^f}{1-\tau^d}$	Tax exemption $\kappa = 1$
The classical system $\tau_{dist}^d = \tau^d$, $\phi = 0$	$\tau^f > \tau_c^f$	$\frac{(\tau^f-\tau_c^f)}{(1-\tau_c^f)} > \tau^d$	$\frac{(\tau^f-\tau_c^f)}{(1-\tau_c^f)} > \tau^d$	Not possible
The imputation system $\tau_{dist}^d = \tau^d$, $\phi > 0$	$\frac{(\tau^f-\tau_c^f)}{(1-\tau_c^f)} > \phi$	$\frac{(\tau^f-\tau_c^f)}{(1-\tau_c^f)} > \tau^d$	Not possible	Not possible
The split rate system $\tau_{dist}^d < \tau^d$, $\phi = 0$	$\tau_{dist}^d > \frac{\tau^d(1-\tau_c^f)-(\tau^f-\tau_c^f)}{(1-\tau^f)}$	$\frac{(\tau^f-\tau_c^f)}{(1-\tau_c^f)} > \tau^d$	Not possible	Not possible

The standard result in a closed economy model of a higher cost of capital in the new share issue regime under the classical system reappears in this context only as a special case as is clear from table 2. This is when no method is employed for mitigating IDT, see column I. In all other cases the parameter values are quite restrictive[20] for implying a higher cost of capital

[20] A domestic corporate tax rate less than 21 percent when $\tau^f = .35$ and $\tau_c^f = .5\tau^f$ as an example.

in the new share issue regime, and not possible in 5 cases. The conclusion from this comparison is that, given that any method is employed for mitigating EDT, the cost of capital is most likely higher in the retention regime compared to the new share issue regime. Hence, the effect of mitigating EDT and IDT more than offset the fact that the subsidiary in the retention regime uses initial the less expensive source of finance at the margin.

3.5 The effect on the market value

Under the new share issue regime the market value for a subsidiary is reported in (8). The amount of new share issues N^f is positive implying that it is not possible to draw any conclusions of how the market value changes due to the methods of mitigating EDT and IDT. But, for a subsidiary in the retention regime the effect can be analyzed. This is because the amount of new share issues equals zero at the margin, implying that the market value in (8) can be rewritten as;

$$V = \frac{\kappa}{1-\tau_c^f}\frac{1-\tau_{dist}^d}{1-\phi}\int_{t=t_0}^{\infty}\left[F(K)-\frac{1}{1-\tau^d}\left(I-\tau^d\delta K\right)\right]e^{-i\frac{1-\tau^f}{1-\tau_c^f}(t-t_0)}dt. \qquad (17)$$

The term $\frac{\kappa}{1-\tau_c^f}\frac{1-\tau_{dist}^d}{1-\phi}$ in (17) represents the capitalization effect that arises in the retention regime when different methods are employed for mitigating EDT and IDT. The effects are summarized in table 3.

Table 3: The capitalization effect in the retention regime

	I	II	III	IV
	No method $\kappa = 1-\tau^f$	Tax credit, scenario 1 $\kappa = (1-\phi)\frac{1-\tau^f}{1-\tau_{dist}^d}$	Tax credit, scenario 2 $\kappa = \frac{1-\tau^f}{1-\tau^d}$	Tax exemption $\kappa = 1$
The classical system $\tau_{dist}^d = \tau^d$, $\phi = 0$	$\frac{(1-\tau^f)(1-\tau^d)}{(1-\tau_c^f)}$	$\frac{(1-\tau^f)}{(1-\tau_c^f)}$	$\frac{(1-\tau^f)}{(1-\tau_c^f)}$	$\frac{(1-\tau^d)}{(1-\tau_c^f)}$
The imputation system $\tau_{dist}^d = \tau^d$, $\phi > 0$	$\frac{(1-\tau^f)(1-\tau^d)}{(1-\tau_c^f)(1-\phi)}$	$\frac{(1-\tau^f)}{(1-\tau_c^f)}$	$\frac{(1-\tau^f)}{(1-\tau_c^f)(1-\phi)}$	$\frac{(1-\tau^d)}{(1-\tau_c^f)(1-\phi)}$
The split rate system $\tau_{dist}^d < \tau^d$, $\phi = 0$	$\frac{(1-\tau^f)(1-\tau_{dist}^d)}{(1-\tau_c^f)}$	$\frac{(1-\tau^f)}{(1-\tau_c^f)}$	$\frac{(1-\tau^f)(1-\tau_{dist}^d)}{(1-\tau_c^f)(1-\tau^d)}$	$\frac{(1-\tau_{dist}^d)}{(1-\tau_c^f)}$

From table 3 it is clear, by comparing column I with the rest, that the market value of the subsidiary increases when a method is put to use for mitigating IDT. Remember from (9) that the methods of mitigating EDT or IDT have no effect on the cost of capital. Any attempt to increase the investment volume by decreasing the cost of capital fails when the subsidiary finances the marginal investment with retained earnings. The result is instead an increased market value.

Given a specific method of mitigating IDT the capitalization effect will depend on how the method is designed. Column I in table 3 illustrates that the methods of mitigating EDT is capitalized in the market value when the income is taxed fully international. The capitalization effect implies that the market value increases under the imputation and split rate systems, compared to the classical system. The result reappears in the tax credit method when the domestic government ignores to adjust for a lower domestic effective tax rate (scenario 2), see column III.

A quite surprising result appears under the method of tax credit (scenario 1) where the foreign government uses the effective tax rate when calculating the amount to credit. The imputation and the split rate systems are not capitalized in the market value as is clear from column II. At the same time the cost of capital is unaffected since the subsidiary finances the marginal investment with retained earnings. Depending on the relative magnitude of the parameters the same conclusions appear under the method of tax exemption as well, see column IV. The question is then obvious; who benefit when methods of mitigating EDT is introduced in these cases?

The distribution of the tax liability between the subsidiary and the parent depends on which method that is employed for mitigating EDT under the tax credit.[21] Following the derivations from chapter 2 the amount of tax paid by the foreign parent on dividends becomes $T^f = D\left(\dfrac{\tau^f - \tau^d_{eff}}{1-\tau^d_{eff}}\right)$. The effective corporate tax rate τ^d_{eff} takes different values depending on how the tax credit is designed and which method that is used for mitigating EDT, but $\tau^d_{eff} < \tau^d$

always holds. The effect of a positive change in τ_{eff}^{d} on the amount of tax paid by the foreign parent is negative. Hence, a reduced τ_{eff}^{d} implies that the tax liability in the foreign parent rises while it is reduced in the subsidiary. The tax liability is in some way exported from the domestic subsidiary to the foreign parent. In summary, the amount of tax paid increases in the foreign country and decreases in the domestic country, while the cost of capital in, and the market value of, the subsidiary in the domestic country are unchanged.

4 Summary and conclusions

In determining the cost of capital in a domestic corporation (the subsidiary) with a foreign marginal shareholder (the parent) several factors must be considered. The source of finance at the margin plays a crucial role. It is shown that for a corporation that finances the marginal investment with retained earnings the cost of capital is unaffected both of methods of mitigating EDT and IDT. This is fully explained by the fact that the cost of capital is unaffected of any factors affecting the amount of distributed dividends. The effect is instead an exported tax liability or capitalization of the market value. Hence, there is no meaning using any method of mitigating neither EDT nor IDT if the motive is to mitigate the double taxation. On the other hand, as long as the corporation finances the marginal investment with new share issues the methods of mitigating EDT and IDT do affect the cost of capital. The outcome depends on which method that is used and how they are designed.

Besides the domestic corporate tax rate two methods of mitigating EDT are analyzed; the imputation and the split rate systems. The effect on the cost of capital depends on which method that is used for mitigating IDT. Under the method of tax exemption both the imputation and the split rate systems remains useful, in the meaning of affecting the cost of capital in an open economy. This is also the case under the method of tax credit as long as the foreign government does not adjust the amount of tax to credit. But, if the foreign government adjusts the amount the methods no longer affect the cost of capital. The cost is lowest under the tax exemption, given that the foreign corporate tax rate is larger than the domestic counterpart. It is further shown that the cost of capital is higher in the retention regime than in the new share issue regime as long as any method is used for mitigating the EDT totally.

[21] Since the foreign parent do not pay any tax on dividends under tax exemption it is only interesting to focus on

Even though the marginal shareholder is foreign the domestic corporate tax rate will always affect the cost of capital in a domestic corporation in an open economy. It does not matter if the corporate income is taxed twice at the corporate level or if any method is employed for mitigating IDT. Further, the source of financing the marginal investment does not matter.

the method of tax credit.

References

Auerbach, A. J., 1983, “Taxes, Corporate Financial Policy and the Cost of Capital”, *Journal of Economic Literature*, Vol. XXI, September, pp. 905-940.

Auerbach, A. J., 1984, “Taxes, Firms Financial Policy and the Cost of Capital: An Empirical Analysis”, *Journal of Public Economics* 23, pp. 27-57.

Bergström, V. and Södersten, J., 1981, “Double Taxation and Corporate Capital Cost”, in Eliasson, G. and Södersten, J. (eds.), Business Taxation, Finance and Firm Behavior, Proceedings of a Symposium at IUI, Stockholm, August 28-29, 1978, IUI Conference Reports 1981:1, Almqvist & Wicksell International, Stockholm.

Boadway, R. and Bruce, N., 1992, “Problems with Integrating Corporate and Personal Income Taxes in an Open Economy”, *Journal of Public Economics* 48, pp. 39-66.

Devereux, M. P. and Freeman, H., 1995, “The Impact of Tax on Foreign Direct Investment: Empirical Evidence and the Implications for Tax Integration Schemes”, *International Tax and Public Finance* 2, pp. 85-106.

Hines Jr., J. R., 1994, ”Credit and deferral as international investment incentives”, *Journal of Public Economics* 55, pp. 323-347.

Keen, M. J., 1990, ”Corporation tax, foreign direct investment and the single market” in Winters, L. A and Venables, A. J. (eds.), 1990, European integration: Trade and industry, Cambridge University Press, Cambridge.

King, M. A., 1974, “Taxation and the Cost of Capital”, *Review of Economic Studies* 41, pp. 21-35.

OECD, 1991, Taxing Profits in a Global Economy: Domestic and International Issues, OECD Publications, Paris.

OECD, 1996, Model Tax Convention on Income and on Capital, condensed version, OECD Committee on Fiscal Affairs.

Poterba, J. and Summers, L., 1985, “The Economic Effects on Dividend Taxation”, in Altman, E. and Subrahmanyam (eds.), 1985, Advances in Corporate Finance, Richard D. Irwin.

Sinn, H.-W., 1993, “Taxation and the Birth of Foreign Subsidiaries” in Long, -Ngo-Van (eds), 1993, Trade, welfare, and economic policies: Essays in honor of Murray C. Kemp., Studies in International Trade Policy. Ann Arbor: University of Michigan Press.

Södersten, J., 1977, “Approaches to the Theory of Capital Cost: An Extension”, *Scandinavian journal of Economics*, vol.79, no. 4.

Appendix: Derivation of the cost of capital

The objective function:

$$V_t = \int_{t=t_0}^{\infty} \left(\frac{\kappa}{\left(1-\tau_c^f\right)\left(1-\phi\right)} D_t - N_t^f \right) e^{-i\frac{1-\tau^f}{1-\tau_c^f}(t-t_0)} dt \tag{8}$$

The constraints:

$$D = \left(1-\tau_{dist}^d\right) F\left(K\right) + \frac{1-\tau_{dist}^d}{1-\tau^d}\left(N^f - I + \tau^d \delta K\right) \tag{2}$$

$$D \geq f\left(1-\tau_{dist}^d\right)\left(F\left(K\right) - \delta K\right) \tag{4}$$

$$N^f \geq 0 \tag{5}$$

$$\dot{K} = I - \delta K \tag{6}$$

The problem to maximize:

$$V\left(K\right) = \int_{t=t_0}^{\infty} \Lambda\left(K, \dot{K}, I, N^f, D; t\right) e^{-i\frac{1-\tau^f}{1-\tau_c^f}(t-t_0)} dt$$

where

$$\Lambda\left(\cdot\right) = \frac{\kappa}{\left(1-\tau_c^f\right)\left(1-\phi\right)} D - N^f$$

$$+\mu_D \left[\left(1-\tau_{dist}^d\right) F\left(K\right) + \frac{1-\tau_{dist}^d}{1-\tau^d}\left(N^f - I + \tau^d \delta K\right) - D \right]$$

$$+\eta_D \left[D - f\left(1-\tau_{dist}^d\right)\left(F\left(K\right) - \delta K\right) \right] + \eta_N N^f + \mu_K \left[I - \delta K - \dot{K} \right]$$

The first order conditions:

The conditions satisfy $\frac{d\Lambda}{dI} = \frac{d\Lambda}{dN} = \frac{d\Lambda}{dD} = 0$ and the Euler equation $\frac{d\Lambda}{dK} - \frac{\partial\left(d\Lambda/d\dot{K}\right)}{\partial t} = 0$.

The assumption of a steady state solution implies that $\dot{\mu}_K = 0$.

I: $$-\mu_D \left(\frac{1-\tau_{dist}^d}{1-\tau^d} \right) + \mu_K = 0$$

$$N^f: \qquad -1+\mu_D\left(\frac{1-\tau_{dist}^d}{1-\tau^d}\right)+\eta_N=0$$

$$D: \qquad \frac{\kappa}{\left(1-\tau_c^f\right)\left(1-\phi\right)}-\mu_D+\eta_D=0$$

$$K: \qquad \left(\mu_D-f\eta_D\right)\left(1-\tau_{dist}^d\right)F_K\left(K\right)-\mu_K\left(\delta+\frac{1-\tau^f}{1-\tau_c^f}i\right)$$

$$+\eta_D f\left(1-\tau_{dist}^d\right)\delta+\mu_D\left(\frac{1-\tau_{dist}^d}{1-\tau^d}\right)\delta\tau^d=0$$

The retention regime (RR)

Under the retention regime is $D>f\left(1-\tau_{dist}^d\right)\left(F\left(K\right)-\delta K\right)$ and $N^f=0$ implying that the shadow values become $\eta_D=0$ and $\eta_N>0$. This gives following first order conditions:

$$I': \qquad \mu_K=\mu_D\left(\frac{1-\tau_{dist}^d}{1-\tau^d}\right)$$

$$K': \qquad F_K\left(K\right)=\frac{\mu_K\left(\delta+\frac{1-\tau^f}{1-\tau_c^f}i\right)-\mu_D\frac{1-\tau_{dist}^d}{1-\tau^d}\delta\tau^d}{\mu_D\left(1-\tau_{dist}^d\right)}$$

The net cost of capital is then given from I' and K' as:

$$\rho^{RR}=F_K\left(K\right)-\delta=\frac{\left(1-\tau^f\right)i}{\left(1-\tau^d\right)\left(1-\tau_c^f\right)} \qquad (9)$$

The new share issue regime (NSIR)

Under the new share issue regime is $D=f\left(1-\tau_{dist}^d\right)\left(F\left(K\right)-\delta K\right)$ and $N^f>0$ implying that the shadow values become $\eta_D>0$ and $\eta_N=0$. This implies that the first order condition can be rewritten as;

$$N^{f'}: \qquad \mu_D=\left(\frac{1-\tau^d}{1-\tau_{dist}^d}\right)$$

$$I':\qquad \mu_K = \mu_D\left(\frac{1-\tau^d_{dist}}{1-\tau^d}\right) = 1$$

$$D':\qquad \eta_D = \mu_D - \frac{\kappa}{\left(1-\tau^f_c\right)\left(1-\phi\right)} = \frac{1-\tau^d}{1-\tau^d_{dist}} - \frac{\kappa}{\left(1-\tau^f_c\right)\left(1-\phi\right)}$$

$$K':\qquad F_K\left(K\right) = \frac{\mu_K\left(\delta + \frac{1-\tau^f}{1-\tau^f_c}i\right) - \eta_D f\left(1-\tau^d_{dist}\right)\delta - \mu_D\left(\frac{1-\tau^d_{dist}}{1-\tau^d}\right)\delta\tau^d}{\left(\mu_D - f\eta_D\right)\left(1-\tau^d_{dist}\right)}$$

The net cost of capital is then given from $N^{f'}$, I', D' and K' as:

$$\rho^{NSIR} = F_K\left(K\right) - \delta = \frac{\left(1-\tau^f\right)i}{\left(1-f\right)\left(1-\tau^d\right)\left(1-\tau^f_c\right) + f\kappa\left(1-\tau^d_{dist}\right)\frac{1}{1-\phi}} \qquad (10)$$